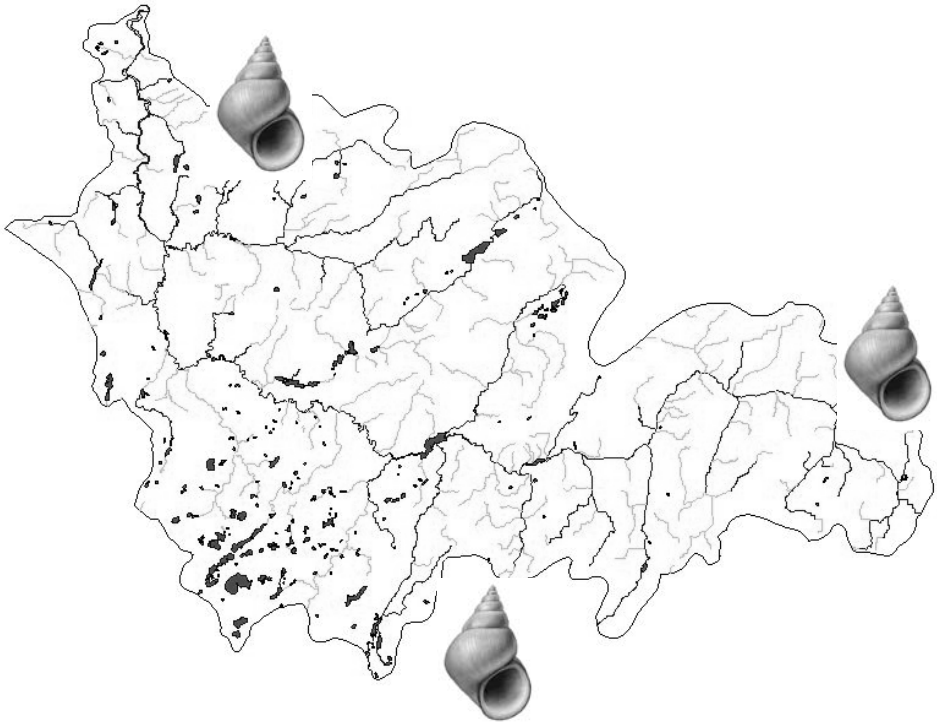
Integrating Aquatic Invasive Species Management into the Western Watershed Council Framework… An Investigation of Needs and Opportunities



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Executive Summary

Aquatic invasive species (AIS) are an extremely relevant issue to the rapidly growing realm of local watershed management efforts. AIS affect watershed health and can negate the substantial resources being directed toward watershed restoration. Given their community connections and monitoring, outreach, and habitat enhancement roles, watershed management groups offer unique opportunities to manage AIS at a local scale. Over 400 watershed groups operate in California, Oregon, and Washington. Anecdotal evidence suggested that few of these groups address AIS. Before attempting to remedy this gap via education and technical assistance programs, the Western Regional Panel of the federal Aquatic Nuisance Species Task Force funded a needs assessment addressing coastal watershed groups in California, Oregon, and Washington. The project goals were to: (1) measure awareness and action regarding the issue of AIS; (2) determine how AIS were addressed by assessment, monitoring and restoration guidance and technical materials used by the West Coast groups (and associated reports generated by these groups); and (3) learn what watershed groups need in terms of information and training to assist them in addressing AIS.

Although limited in scope, results from this project's review of watershed management documents and surveys of watershed group coordinators are consistent with the hypothesis that AIS are inadequately addressed by watershed groups. Most guidance materials did not address AIS monitoring, impacts, prevention, or control; similarly, neither did associated reports by watershed groups. Where invasive species were addressed, terrestrial and riparian weeds dominated the focus. Most watershed coordinators reported that AIS was an important issue but pointed to lack of information, funds, and an already overwhelming workload as barriers to attending to this problem. Few watershed groups had complete information on the full extent of AIS occupying their watershed. The project revealed significant differences among coastal watershed group structure and focus in each state, as well as inconsistency in references/resources guiding their efforts.

This evaluation confirms significant opportunities, and associated benefits, to increasing the capacity of West Coast watershed groups regarding AIS management. Recommended steps for further engaging Western watershed groups in AIS issues include:

- **Incorporate information into guidance documents in a way that helps watershed groups fold AIS assessment, prevention, control, and monitoring into their existing activities.**
- **Provide more standardization of watershed group protocols/procedures.**
- **Provide additional training for watershed groups.**
- **Increase AIS funding to watershed groups.**
- **Create a closer link between watershed groups and the WRP.**
- **Improve coordination among West Coast watershed groups**
- **Expand this needs assessment.**

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The many watershed group coordinators participating in this project.

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Introduction

Aquatic invasive species (AIS) are receiving greater attention as a priority environmental concern by state, regional, tribal, and national programs. How are local watershed management programs addressing this issue? AIS may have the potential to disrupt watershed restoration efforts (Ruckelshaus, Levin et al. 2002), and may ultimately impair or impede a watershed group's ability to reach its planning and restoration goals. In turn, local watershed management groups have a unique placement in the challenge to manage AIS. They have a close relationship with their watershed and may be the first to notice impacts. They have a vested interest in watershed health, both economically and environmentally. They have direct contact with watershed residents and interest groups, and can disseminate information quickly. They also have the ability to affect their community's behavioral norms. Many of these groups are already undertaking monitoring and restoration efforts. Therefore, watershed groups are poised to become key players in the effort to combat the spread and establishment of AIS.

State AIS management plans have recognized the need to involve watershed groups at the front line in managing AIS. For example, Oregon's AIS Management Plan (2001) includes objectives such as "Work with watershed councils to ensure that the ANS strategy is coherent and consistent throughout Oregon" and "Work with watershed council (sic) to ensure ANS are included in ongoing monitoring programs." Watershed assessments and long-term monitoring that incorporate AIS can greatly expand a region's capacity for early detection of new invasions. Watershed management plans that include local methods for restricting pathways of AIS introduction can fill the gaps not addressed by state, federal, and other programs. Many watershed groups are already addressing control of high profile terrestrial/riparian invasive plants and therefore have the foundation to expand into the aquatic realm. Watershed groups often use community education tools to carry out their mission, and could use this capacity to meet AIS outreach needs.

For the Sake of the Salmon, a recently defunct group that provided coordination and technical support to organizations along the West Coast, identified over 400 watershed groups operating in California, Oregon, and Washington. The term "watershed group" covers a broad assembly of entities working toward improving the environmental health of a specific watershed, including watershed councils, "Friends of Creek" groups, etc. In this report, "watershed group" is used to address all forms of this organization type operating at scales from small urban tributaries to major river basins. Watershed groups vary by differing membership composition, focus activities, mandates, scale, and funding structures. The duties of these groups may include watershed health assessment, planning, restoration activities, and monitoring efforts. Many watershed groups work in concert with regulatory bodies, but their character is typically non-regulatory. Some groups focus solely on advocacy. Other groups take on technical advisory roles. Many work as an offshoot of, or in close contact with local, state and federal agencies.

Particularly in the Pacific Northwest, improving habitat for threatened/endangered salmonid species is a driving force for most watershed restoration work. For example, the Oregon Coastal Salmon Restoration Initiative states that:

> "Watershed councils are expected to be the backbone of the habitat portion of the Coastal Salmon Restoration Initiative. An important aspect of long-term salmon recovery is the ability to integrate watershed assessments and to implement recovery efforts throughout all ownerships in the watershed."

Other groups may be focused on water quality improvement designed to meet a particular mandated standard or goal (e.g., EPA Dissolved Oxygen standards). Many watershed groups employ hands-on aquatic monitoring activities. This monitoring covers a broad range of activities and may be carried out by volunteers, contracted out to private firms or public entities, or performed by paid staff. The monitoring itself may be focused toward a particular parameter, such as temperature or oxygen content in the water column, have multiple foci, or may be quite comprehensive in scope.

Although the focus of all of these groups is upon their watershed, their organizational structure takes varying forms. This variation is quite evident on the West Coast, where each state seems to have taken a differing approach to watershed group structure. In Washington, watershed groups tend to be based at the county level and are commonly an outgrowth of county government. Washington's coastal watershed groups often consist of members that include elected county or tribal officials, county employees, and concerned citizens. An example of this structure can be found in the Dungeness River Management Team. This Group is made up primarily of members representing the City of Sequim, Washington Department of Fish and Wildlife, the Jamestown S'Klallam Tribe, Clallam County, the North Olympic Land Trust, sportfishing groups, and property owners. The group's focus is on integrated planning to restore the watershed's natural resources (http://www.olympus.net/community/dungenesswc/History.htm).

Oregon's watershed council structure is somewhat more standardized due to direction by the Oregon Watershed Enhancement Board (OWEB) and coverage by land use planning laws. Watershed councils in Oregon are comprised of a diverse group of stakeholders in the basin, including landowners, concerned citizens, local government authorities, etc. These groups focus on planning and restoration efforts with considerable concentration on salmon habitat restoration. An example of this structure can be found in the Midcoast Watershed Council, whose bylaws state "The Council is composed of all interested citizens…" and call for representation from aquaculture, timber, fishing, and agriculture interests; local government; academics; tribes; and others. The Midcoast Watershed Council also is incorporated as a non-profit organization, and employs a technical assistance team (*www.midcoastwatershedcouncil.org/bylaws.htm*).

California watershed groups are the most diverse, and include a variety of structures, such as legal advocacy groups, 'Friends' groups (groups with a focus on community activism, political action, and/or community education), groups organized around a particular issue, and groups with an affiliation to a larger organization. The Carmel River Watershed Organization

(http://www.carmelriverwatershed.org/crwcorg.html) has a structure similar to the Oregon model, focusing membership on various "stakeholders." Another group, California Trout, is a membership-based advocacy group, which focuses on planning, public information dissemination and occasionally site-specific restoration efforts (http://www.caltrout.org/consact.html). "Friends of the Los Angeles River" exemplifies a typical "Friends" group (http://www.folar.org). This group engages in hands-on restoration activities for its volunteers, as well as political activism and community education about watershed issues.

Methods

Anecdotal evidence suggested that West Coast watershed groups rarely address AIS in their various programs. Similarly, cursory review of several watershed group guidance materials revealed a lack of comprehensive general guidelines for addressing AIS. Because AIS issues are a relatively recent concern in the area of watershed health, it was assumed that a thorough examination of these guidance materials and reports which were generated from their use would reveal an absence of AIS references. Before attempting to remedy this problem via education and technical assistance programs, more information was needed to determine if these assumptions were true and to gauge watershed group needs and perceptions regarding AIS management.

At their fall 2002 meeting, the Western Regional Panel of the federal Aquatic Nuisance Species Task Force agreed to support a needs assessment that would set the stage to build AIS management capacity among Western watershed groups. The project was carried out by Oregon State University Extension Sea Grant under a subcontract with the Pacific States Marine Fisheries Commission. Due to financial limitations, the needs assessment scope was limited to coastal watershed groups in California, Oregon, and Washington. Not only is this region particularly endowed with active watershed organizations, but the diversity of these groups conferred the potential for the study's findings to relate to other regions in the West.

There were three basic goals of this project. The first goal was to ascertain the level of awareness and action among West Coast watershed councils regarding the issue of AIS in general as well as a number of high-profile species representing current priority threats. The second goal was to find out if/how AIS were addressed by assessment, monitoring and restoration guidance and technical materials used by West Coast watershed groups. The third goal was to document what watershed groups need in terms of information and training to assist them in addressing AIS in their watersheds. The timing of this project allowed it to dovetail with an initial outreach project at Oregon State University that evaluated methods for building initial AIS awareness among Oregon coastal watershed councils.

Technical Support

An advisory committee was formed in order to give guidance and different perspectives on the project. Brief contacts with advisory committee members for clarification, suggestions, and review of developed materials were made intermittently through the duration of the project. The list of advisory committee members can be found in Appendix H. Technical support was also provided by Dr. Molly Engle with the Oregon State University Extension Service regarding development

and compilation of surveys and document assessments. Guidance from the Oregon State University Institutional Review Board (IRB) was also incorporated regarding surveys.

Document Review

A document review tool was developed to provide a consistent, semi-quantitative system for evaluating if/how a particular guidance document or watershed report addressed AIS (Appendix A). One initial simple aspect of this review tool involved searching for frequency of various terms that relate to AIS or introduced species in general. Electronic versions of watershed management guidelines were searched for the presence of key words such as "invasive". When searches encountered words not pertaining to introduced species, (e.g., "Introduction" in the context of the introduction of a chapter rather than an actual introduction of a species into the biota) that encounter, or "hit," was not documented. Searches on portions of words gave a broader scope of potential "hits" (thus, typing "Introd" could find introduced, introduction, etc.) and seemed to be more useful in catching pertinent references. Searches were conducted for the following terms: "Alien," "Exotic," "Indigenous," "Introduc," "Invas," "Native," and "Nuisance." When a relevant word was encountered in the document, the context in which it was used was recorded, along with the location of the reference in the document. The tool helped determine whether a distinct section in the document addressed biological invasions in general and/ or AIS in particular. Any reference to specific AIS was noted. The tool also was used to log whether the document addressed methods to prevent, detect, monitor or control AIS. The last portion of the tool addressed data on AIS, noting maps of distribution, species lists, and estimates of populations. The tool also allowed for general comments regarding any other aspects of AIS reflected in the subject document.

Documents reviewed were divided into two categories: guidance documents (e.g., assessment protocols) and watershed reports (developed by watershed councils using guidance documents). Table "D-1" lists the documents reviewed. One challenge faced early in the process was determining which guidance documents were being used by watershed groups. A list of potential review documents was developed based on queries to the advisory committee, online searches, and watershed coordinator surveys (see below). Online searches were run on a number of keywords, including "assessment," "watershed report," "watershed," "water quality," "monitoring," and "restoration." Due to the timeline and search tool involved, all documents reviewed were obtained electronically. At the time of review, no electronic versions of watershed reports prepared by watershed groups in Washington or California were available. This presents a significant gap in the document review portion of the project that could be remedied if this project is ever expanded.

Watershed Group Survey

A survey was developed to obtain needs information directly from coordinators of West Coast watershed groups. Targeted questions were developed and formatted to generate a survey that gave the respondent the ability to provide a range of responses. Open-ended questions were also included to allow input that could pick up issues not specifically addressed. Watershed groups been inundated with surveys recently. For example, in the short period that this project covered, there were at least three other researchers from Oregon State University, developing or implementing surveys targeting Oregon groups. With this in mind, the survey was designed to be completed in less than 20 minutes. Awareness of the numbers of surveys the groups received was

acknowledged in the cover letter (See Appendix C), along with the reason behind the request for participation. The option for not participating was also made clear to the potential respondents.

After gaining approval from the IRB, the survey was mailed on August 11, 2003 to 154 coastal watershed groups in Washington, Oregon and California. Of these, 37 percent went to groups in Washington, 16 percent went to groups in Oregon, and approximately 46 percent went to groups in California. Included were the approved cover letter, survey, and a self addressed stamped envelope for return (See Appendix B and C). To receive IRB approval, confidentiality of survey respondents needed to be insured. To meet this requirement, a method of coding was developed and implemented that still allowed tracking of returned surveys versus unreturned surveys for follow up response purposes. Twenty-four surveys were returned due to unknown or expired addresses. Fourteen surveys were returned after the first request. Two days after the initial return deadline had passed, a reminder letter was sent out to addresses that had not come back as invalid or had not already returned the survey. Six surveys were subsequently requested; of these, three were returned. In total, 36 were received to form the basis of the data analysis.

Groups targeted

The target groups primarily derived from a list of watershed groups in Washington, Oregon, and California provided by the non-profit organization For the Sake of Salmon. Narrowing the group list to only coastal groups was performed by identifying the mailing address on a map, and including any group that could fall within 25-50 miles of a marine habitat. Oregon's list of groups was fairly easy to identify. Oregon's coastal watersheds had previously been documented, and actual maps of the watershed group's focus were readily available to identify the geographical area the groups covered. However Washington and California groups were harder to define given that their names lacked enough geographic specificity to identify their focus area. It was also difficult to identify whether the watershed area covered was a tributary or had an estuarine component. An effort to be inclusive most likely led to inclusion of some noncoastal groups. This may ultimately have resulted in a larger than normal number of nonrespondents.

Microsoft Access databases were developed for contact information, and survey compilation. The survey compilation database was designed for ease of transfer to Microsoft Excel spreadsheets for data analysis. Responses to open-ended questions were entered into the computer verbatim as submitted; general trends/outliers were noted. The range responses were analyzed for mean, median and mode, and standard deviation was computed.

Results

The following tables are organized by the portion of the project they were derived from. All are numbered in a Letter-Number format. "D" denotes the table as having originated from the Document Review, "S" denotes the table as having originated from the Watershed Coordinator survey, and "C," "O," and "W," denote survey results broken down by California, Oregon, and Washington, respectively. Thus, table S-2 would denote the second table in the Survey section. Unless otherwise noted, the sample size for each table is 36 responses.

Document Review
[D-1] Documents Reviewed:

Document Name	Originating Agency	Type of Document	Year
Oregon Watershed Assessment Manual	Oregon Watershed Enhancement Board	Guidance material	1999
Aquatic Bioassessment Lab Worksheet	California Department of Fish and Game	Guidance material	1999
North Coast Watershed Assessment Program Methods Manual	State of California Resources Agency	Guidance material	2001
Puget Sound Protocols and Guidelines	Puget Sound Water Quality Action Team	Guidance material	1996 with updates
Estuarine and Coastal Marine Waters: Bioassessment and Biocriteria Technical Guide	Environmental Protection Agency	Guidance material	2000
A Reference Guide for Monitoring California Rivers, Streams and Watersheds	San Francisco Estuary Institute	Guidance material	Undated (pre-2001)
Aquatic Habitat Assessment-Common Methods	US Fish and Wildlife Service	Guidance material	Undated
Peer Review of Watershed Assessment Methods Manual	North Coast Watershed Assessment Program	Guidance Document	Undated
Nicolai-Wickiup Watershed Assessment	Nicolai-Wickiup Watershed Council	Watershed Report	2000
Youngs Bay Watershed Assessment	Youngs Bay Watershed Council	Assessment Report	2000
Skipanon River Watershed Report	Skipanon River Watershed Council	Assessment Report	2000

[D-2] Summary of **AIS** focused sections found in document

	Yes	No
Does document have distinct section on invasive species?	0	11
Does document have distinct section on AIS?	0	11
Does document reference AIS as an impact to Watershed health?	2	9
Does document address methods to prevent introductions?	2	9
Does document address methods to detect new introductions?	0	11
Does document address methods to monitor existing invasions?	0	11
Does document address methods to control existing invasions?	1	10

[D-3] Focus of Data:

Maps of distribution?	0/11
Species lists?	2/11
Reports numbers?	1/11
Prevention programs mentioned?	0/11
Recognized AIS as issue to be explored?	1/11

[D-4] Presentation of Data

	Maps of Distribution?	Species Lists?	Report Numbers?	Prevention Programs Mentioned?	Recognized AIS as issue to be explored?
Skipanon River Watershed Report	No	No	No	No	No
Oregon Watershed Enhancement Board	No	No	No	No	No
Nicolai-Wickiup Watershed Assessment	No	No	No	No	No

[D-4] Presentation of Data (continued)

	Maps of Distribution?	Species Lists?	Report Numbers?	Prevention Programs Mentioned?	Recognized AIS as issue to be explored?
Peer Review of Watershed Assessment Methods Manual	No	No	No	No	No
Aquatic Habitat Assessment-Common Methods	No	No	No	No	No
A Reference Guide for monitoring CA Rivers, Streams and Watersheds.	No	Yes	Yes	No	No
Estuarine and Coastal Marine Waters: Bioassessment and Biocriteria Technical Guide	No	No	No	No	Yes
Puget Sound Water Quality Action Team	No	No	No	No	No (more recent edition now does)
North Coast Watershed Assessment Program Methods Manual	No	No	No	No	No
CDFG Aquatic Bioassessment Lab, Bioassess-ment Worksheet	No	No	No	No	No
Youngs Bay Watershed Assessment	No	Yes	No	No	No
Percent “Yes” Responses	0	18.2	9.1	0	9.1

Survey:

[S-1] Number of surveys sent out:

	Number of surveys sent	Percentage of Surveys sent (by state)
Washington	57	37.3
Oregon	26	17.0
California	70	45.8
Total	153	100

[S-2] Total Responses:

	Total responses	Percentage of surveys sent (corrected for undeliverables)
Washington	17	33.3
Oregon	7	30.4
California	11	19.6
Email-Uncoded	1	
Total	36	27.7

[S-3] Responses to questions regarding perceived threat of AIS

Minimal Threat 1 2 3 4 Extreme Threat Don't Know ☐

	Threat to health of Watershed?	Threat to success of restoration efforts?
Mode	3	3
Median	3	3
Mean	2.8	2.6
Standard Deviation	1.1	1.0

[S-4] Summary of responses to: What is your Awareness of:

	Never heard of them (1)	**Don't know if species is in watershed (2)**	**Species not currently in watershed (3)**	**Species in our Watershed (4)**

	Nutria	**Cordgrass (*Spartina spp.)***	**Green Crab (*Carcinus maenas)***	**Zebra mussel (*Dreissena polymorphal*)**	**Chinese mitten crab (*Eriocheir sinensis)***	**"Killer algae" (*Caulerpa taxifolia, med. str.)***	**Hydrilla (*Hydrilla verticillata)***	**Common Carp (*Cyprinus carpio*)**
Mode	2	2	2	2	2	2	2	4
Median	2	2	2	2	2	2	2	3
Mean	2.3	2.6	2.2	2.1	2.1	1.6	1.7	2.7
Standard Deviation	1.3	1.2	1.0	0.8	1.0	0.8	1.0	1.3

	New Zealand mudsnail (*Potamopyrgus antipodariuml*)	**Japanese oyster drill (*Ceratostoma inornatum*)**	**American Bullfrog (*Rana catesbeiana*)**	**Asian clam (freshwater) (*Corbicula fluminea*)**	**Asian clam (estuarine) (*Potamocorbula amurensis*)**	**Atlantic salmon (*Salmo salar*)**	**Elodea (*Egeria densa*)**
Mode	2	2	4	2	2	3	2
Median	2	2	2	2	2	3	2
Mean	1.8	1.9	2.7	1. 9	1.7	2.6	2.1
Standard Deviation	0.9	1.0	1.4	0.9	0.9	1.0	1.1

[S-5] Are non-native species currently included in your watershed assessment?

Yes	**13**
Percentage of "yes" responses	36.1

[S-6] Non-native Species included in watershed assessment:

Species Mentioned	Number of responses
English Ivy (*Hedera helix)*	3
Clematis (*Clematis spp.*)	1
Himalayan Blackberry (*Rubus discolor)*	7
Cordgrass (*Spartina spp.*)	1
Japanese Knotweed (*Polygonum cuspidatum)*	3
Reed Canarygrass (*Phalaris arundenacea*)	5
Elodea	3
Eurasian Watermilfoil (*Myriophyllum spicatum*)	1
Scotch Broom (*Cytisus scoparius*)	1
Gorse (*Ulex europeaus*)	1
Tansy *(Senecio jacobaea)*	1
Thistle (*Salsola spp.*)	2
Giant Knotweed (*Polygonum sachalinense*)	1
Himalayan Knotweed (*Polygonum polystachyum)*	1
German Ivy *(Senecio mikanoides)*	1
Tree-of-heaven *(Ailanthus altissima)*	2
Giant reed (*Arundo domax)*	2
Periwinkle (*Vinca spp.*)	2
French Broom (*Cytisus monspessulanas)*	1
Pampas Grass *(Cortaderia spp.)*	1
Poison Hemlock (*Conium maculatum)*	1
“Riparian Freshwater Aquatic Plants,”	1
Marine Invertebrate and Plant species.”	1

[S-7] Nonnative Species Monitored?

	Number of responses	Percentage of responses
No nonnative species monitored	13	36.1
Same species monitored as in watershed assessment	5	13.9

[S-8] Other species monitored (species monitored for but not included in the original assessment):

Purple Loosestrife *(Lythrum salicaria)*	2
Reed Canarygrass	2
Japanese Knotweed	3
Cordgrass	1
American Bullfrog	1
Green Crab	1
Mitten Crab (*Eriocheir spp.*)	1
"Riparian Plant Species"	1

[S-9] Invasive Species monitoring – additional narrative comments:

Frequency	**Primary Protocol/Guideline followed**
No Program	
None, currently	
Ongoing	Low Elevation aerial photos field mapping
We know Japanese- Knotweed there	
None	
New Zealand mud snails	
Periodic	Knotweed-Density mapping, Spartina
Annually-Purple Loosestrife, Monthly- Mitten crab	Loosestrife- OSU/ODA, Mitten crab/Traps/PSU
Sporadic	Invasive Weeds/animals that we know
?	Visual checks at planting locations
Monthly	SKFG
None	
Annual	TNC
?	Professional Biologist, details unknown
Quarterly/annually	*Spartina* is usually surveyed
None	Currently developing protocol
Irregular	GPS Mapping
None	
Annual-plants	Field survey

Watershed Restoration/Action Plans:

[S-10] Has your group developed a watershed restoration/action plan?

	Number of Responses	Percentage of responses
Yes	21	58.3
No	15	41.7

[S-11] Does your watershed restoration/action plan include aquatic/riparian nonnative species eradication?

	Number of responses	Percentage of responses
Yes	12	33.3
No	24	66.7

[S-12] What species are addressed in the watershed restoration/action plan (narrative comments)?

Eradication species addressed
It will as we have become aware of these invasive species like New Zealand mud snail
Ivy, etc. listed earlier. An adopt a park group works exclusively on invasives in Fauntilroy Park (the creek headquarters).
Spartina, knotweeds
Not finished
Mentions noxious weeds, but nothing very specific.
Not all, not yet. Elodea, purple loosestrife, reed canarygrass, are candidates for "Control"
Primarily reed canarygrass
Knotweed, blackberry, reed canarygrass
Knotweed: creating cooperative weed management area for the Stillaguamish basin with 8 agencies involved, based on the Skagit model.
Remove bullfrogs in one large pond
Broom, Vinca, Cape Ivy in riparian areas, *Arundo*, Himalayan blackberry, beachberry, fennel, Spartina spp. in tidal area.
No. It does include assessment/surveys of aquatic communities
This information is currently being developed.
Arundo donax, English Ivy, *Vinca*, tree- of-heaven
Arundo, Vinca major, French broom, Himalayan berry, thistle sp. Pampas grass, *Ailanthus*, poison hemlock
N/A but doubtful. Remains to be determined if this is a high priority action
Minimal. Frequently is a component of restoration projects, but not normally major part.

[S-13] Does your Watershed restoration/action plan include aquatic/riparian non native species long term control?

	Number of responses	Percentage of responses
Yes	8	22.2
No	28	77.8

[S-14] What species are addressed - comments?

Long term control species addressed
It will if we find during assessment
Through the upcoming vegetation management plan.
Not Finished
Purple loosestrife - Bio-control
No, not yet. We are working with PSU lakes program to develop a management plan- Erin Harwood, PSU grad student.
Reed Canarygrass
This is a multi year program with continued annual review and treatment
It will
See above (Broom, Vinca, Cape Ivy in riparian areas, *Arundo*, Himalayan blackberry, beachberry, fennel, Spartina spp. In tidal area.) Removal and planting with natives
It will have 5 year implementation plans
There's an appendix of fact sheets on the invasives which includes control measures
N/A Plan underway, but not a likely outcome

[S-15] Does your watershed restoration/action plan include aquatic/riparian nonnative species prevention?

	Number of responses	Percentage of responses
Yes	5	13.9
No	31	86.1

[S-16] What species are addressed by your restoration/action plan? - Comments

It will if we find evidence during assessment
Not at this time, other than trying to control light (I.e., encouraging more shade with canopy).
Not Finished
No, not yet.
Trying to get the word out to citizens, as well as to developers, contractors, mining companies
Will generally address trying to keep out
We have prioritized recreational bay users and outreach to minimize ecological effects of kayaking, boating, etc.
There will be a public outreach and eradication component and regular observation efforts.
Promotes value of importance of healthy native plant communities
N/A Plan underway, but not a likely outcome

[S-17] What information on Aquatic Nuisance Species management would be helpful to your Watershed Council?

Least Helpful→ 1 2 3 4 →Most Helpful Don't Know – D/K

	Prevent introductions	How to Monitor	How to Detect	How to Control/ Eradicate
Mode	4	4	4	4
Median	3	3	3	4
Mean	2.9	2.8	2.9	3
Standard Deviation	1.4	1.3	1.3	1.4

[S-18] What type of informational tools would be valuable to your Watershed Council, to facilitate management of Aquatic Nuisance Species?

Least Helpful→ 1 2 3 4 → Most Helpful Don't Know – D/K

	Videos	Guidance Manuals	Workshops	Pilot Project	Web Site
Mode	4	4	4	4	4
Median	2	3	3	3	3
Mean	2.3	2.8	2.6	2.6	2.7
Standard Deviation	1.4	1.3	1.4	1.4	1.4

[S-19] Training workshop preferences:

Preferred times	Number of Responses
Weekend	7
Weekday	11
Evening	3
Fall	4
Spring	11
Winter	9

General trends in results:

Document review
Most documents reviewed did not address AIS or related terminology. Nonnative species were generally given cursory treatment. Most often, introduced species/nonnative species that were mentioned were riparian weeds, such as Himalayan Blackberry (*Rubus discolor)* and Reed Canarygrass (*Phalaris arundinacea*), with a few aquatic weeds (i.e., *Spartina* and *Elodea*) noted occasionally.

Native species were mentioned in a few protocols, including fish and riparian vegetation, with the tendency to eliminate species that were not native from consideration in assessment and monitoring efforts (i.e., only counting "native" species). A correlation appears to exist between the lack of mention in the original protocol, and the subsequent reports generated. For example, the OWEB Assessment Protocol notes in Component IX a list of "Critical Questions," such as

"Which salmonid species are native to the watershed, and which have been introduced?" and "Are there potential interactions between native and introduced species?" To address these questions, the protocol calls for a section on "Stocking History." It promotes identification of fish in the watershed as 'native' or 'exotic' as well as the evaluation of negative interactions between native and non-native fish species (focused only on fish that were intentionally introduced.) Not surprisingly, at least one report generated from this protocol addresses native and stocked introduced fish, while other nonnative species only are mentioned cursorily.

With one exception, the documents reviewed lacked a section specifically focused on nonnative species in general, or AIS in particular. AIS early detection, control, and prevention measures were also absent in general from guidance materials and related watershed group reports.

Surveys

Of the surveys sent out, fifteen percent of the surveys were non-responses due to undeliverable status of the address. Just over twenty-seven percent of the remaining surveys were completed and returned at the time of final compilation. Although no one mentioned the concurrent educational presentation delivery project being conducted by Oregon State University for select watershed councils on the Oregon coast, it would seem unlikely that they would come away without being more aware of the issue of AIS and how they could effect their restoration efforts. The threat of AIS was rated higher in Oregon than in California; however the responses were comparable to those of Washington.

General Awareness Responses

The majority of watershed coordinators responded that the threat AIS presented to the health of their watershed ranked three on a 1-4 scale (with "4" being "extreme threat"). Similarly, when coordinators rated the threat AIS presented to their watershed restoration efforts the most common response was again "3" on the same 1-4 scale. These results indicate that the watershed coordinators surveyed generally recognize AIS as an important issue in regard to the health of their watershed. However, they also note that little attention is afforded issues of AIS in their watershed planning and restoration efforts. This dearth of attention may have several root causes: lack of funding, lack of protocols addressing AIS, and an already overwhelming workload.

In terms of specific AIS problems, the respondents most frequently noted bullfrog and the common carp to occur in their watershed. Atlantic salmon (*Salmo salar)* was the most common response for species "not currently in our watershed." The remaining 14 species listed in the survey were most often rated as, "Don't know if species is in our watershed." This indicates that there is a need for both education to watershed groups about potential nuisance species, as well as a lack of solid information on how widespread these species may be along the West coast of North America.

Watershed Assessment Responses

Most watershed group coordinators reported that at least one assessment report had been prepared for their watershed. In many cases, assessments focus on subwatersheds and only a portion of subwatersheds have been assessed. The majority of the respondents reported an assessment date of

2000 or later. Thirty-six percent of watershed coordinators confirmed that nonnative species are included in their watershed assessments. These responses indicate that few, if any assessments, examined the watershed for nonnative species in the water column or benthic habitats. Overall, riparian and aquatic plants - particularly Himalayan blackberry (*Rubus discolor)* and reed canarygrass (*Phalaris arundinacea)* - were the most common nonnative species addressed. Some responses were more general in nature and simply noted "Riparian Freshwater Aquatic Plants," and "Marine Invertebrate and Plant species." The latter was the only inclusion of any animals in the responses given.

Watershed coordinators cited a variety of guidance materials used to support watershed assessments. All Oregon watershed coordinators cited the Oregon Watershed Enhancement Board manual as the document used in performing their assessment. Two California watershed coordinators cited use of the California Department of Fish and Game manual but there were many others cited as well. Every Washington watershed coordinator cited a different protocol as the guidance document used in their assessment. With the exception of the Oregon groups, there was little standardization with regard to assessment protocols used.

Monitoring

Water quality appeared to be the most comprehensive monitoring focus among responding watershed groups, with many coordinators reporting regular monitoring schedules. Often the monitoring was according to state guidelines, and may have been performed by state or local government agencies. Habitat monitoring was reported to be more varied in frequency, spanning "no monitoring," to once per year, to "ongoing" or "project- specific" monitoring. Protocols used did not seem as uniform in scope as those cited for water quality monitoring and addressed various monitoring targets, such as instream flows or salmon spawning.

"Monitoring of Invasive Species" were the least uniform responses given, ranging in frequency from "no monitoring," to "annual" monitoring. Protocols cited included aerial photography, GPS-based mapping, and visual checks at planting locations. One respondent noted that a protocol was currently being developed, and another respondent noted that there was work being done with Portland State University utilizing mitten crab traps. This was the only response that identified a specific animal species that was being monitored, although one other respondent mentioned "animals that we know," as a monitoring target in this category. Under the category of "Other monitoring," one response included purple loosestrife, nutria and *Elodea sp.*

Thirty-six percent of respondents noted that no nonnative species were monitored in their watershed. Fewer than fourteen percent of respondents said that the nonnative species monitored were the same as those noted in their assessment. Species that were monitored by a group but not addressed in their watershed assessments included purple loosestrife, American bullfrog, European green crab, mitten crab, Japanese knotweed, reed canarygrass, *Spartina*, and "riparian plant species." Surveys indicated watershed groups are open to changing the species they monitor to include species not targeted in their original assessment reports when a need is recognized.

Watershed Restoration/Action Plans:
Over 58 percent of respondents had developed a watershed restoration/action plan, with the majority of the plans being developed after 1998. Six plans were reported as under development. Guidelines used to develop the plans included those produced by the Oregon Watershed Enhancement Board, California Department of Fish and Game, and Washington Department of Ecology.

Roughly one-third of coordinators surveyed said that their plan included AIS eradication strategies. When asked which species were addressed, the most common category of response was riparian plants. One response included a bullfrog eradication effort in a pond. Other responses indicated that plans were either not specific, that AIS may not be a high priority, or that AIS eradication was a minimal part of the plan. Slightly over eight percent of respondents stated their restoration/action plan included long-term control of aquatic/riparian nonnative species. Again, the majority of species addressed were riparian weeds.

Less than 14 percent of respondents affirmed their restoration/action plan included aquatic/riparian non-native species prevention. Prevention efforts included education of citizens and private companies, outreach to recreational users, and habitat modification (shade enhancing efforts). In instances when non-native species prevention was addressed in the restoration/action plan, it was usually not species-specific. Most comments regarding prevention only addressed riparian weed issues.

These responses indicate that although just over half of the respondents had developed a watershed restoration/action plan, eradication, long-term control, and prevention of AIS has been addressed only sporadically in these plans. For groups whose restoration/action plans were still being formulated, there was evidence of interest in the possibility of including these issues in the finished product.

Information/Training needs:
When asked what information on AIS management would be helpful to the watershed groups, there was little spread in the responses; each category (prevention, monitoring, detection, control/eradication) received high responses with a mode value of 4 on a 1-5 scale, 5 being greatest. Median scores were 3 or greater, with "How to control/eradicate" getting the highest response at a value of 4. Given the small sample size, several low-ranking responses were enough to skew the mean significantly.

In terms of AIS education methods, all categories (videos, guidance documents, workshops, pilot projects, websites) received a high mode value. Median responses showed some variation with videos being the lowest rated at 2, and guidance manuals getting the highest rating of 4. Many respondents asked for help with identification of AIS. In terms of training, not surprisingly all time periods had respondents who preferred them. However, the most popular days mentioned were weekdays, and spring was the most popular season mentioned for training.

Conclusions

The results of this study, even based on limited data, appear to support the original hypothesis that AIS represents a significant void in West Coast watershed group programs and the guidance materials that support them. This project has indicated a possible correlation between watershed guidance materials and the products they generate. For example, since most assessment/monitoring responses pertain to riparian weed control, this may have a direct correlation to the finding that riparian weeds are the most often mentioned nonnative species in guidance documents. If AIS information is incorporated into watershed group guidance documents, the watershed groups who use these resources may be more likely to include AIS assessment, prevention, control and monitoring in their watershed planning and management efforts.

When looking at results of both the document review, and the survey, there seems to be little mention of estuarine habitats. Most overall responses targeted freshwater/riparian systems, and most AIS responses mentioned these areas as well. This trend points to a gap in overall estuarine focus. Some comments specifically note the lack of estuarine components for all watershed issues.

The watershed coordinators whose responses were received indicated a high recognition of AIS as an issue that concerned them. The general focus by those cognizant of nonnative species was on riparian vegetation and freshwater animals. Responses supported a need for AIS education, and illustrated the lack of information on species currently in West Coast watersheds. Limited time and resources also appear to be preventing watershed groups from acting on their awareness. When queried regarding the "most useful way to help my watershed council incorporate Aquatic Nuisance Species into our overall focus," assistance with funding was often cited in the survey responses.

Watershed groups in all three states have an assessment, monitoring, restoration, and education/outreach infrastructure in place that could be expanded to include AIS-related activities. Most watershed coordinators responding were very interested in receiving training regarding AIS, particularly with regard to species identification, and prevention and control measures.

Although wide disparity exists among individual watershed groups, there are also trends segmenting groups within the three states examined - most notably in terms of reliance on guidance materials and the invasive species of concern. Washington's coastal groups cited *Spartina* as being the AIS generally known to be present in their watershed, while Oregon and California mostly noted problems with Bullfrogs and Carp. Oregon had only one primary assessment manual in use, but several protocols were cited in Washington and California. Oregon and Washington groups were slightly more likely to view AIS as a potential threat to their watershed's health than those in California. In some cases, this reflected watershed-specific "hot topics." For example, one watershed coordinator in Southern California noted the lack of water as their group's most difficult problem, since their river currently dries up six miles before it gets to the ocean.

The difference in basic structure of the watershed groups is also a point of consideration. The close ties with government agencies reflected within many Washington groups may afford these groups a higher degree of technical expertise than their counterparts can access. However, this structure also could distance the group from the grassroots type of community support and energy that the California groups may exemplify. The standardized structure in place in Oregon may lend itself to a more standardized package of components, which could be utilized by a broad range of watershed groups. For example, in the Oregon Watershed Enhancement Board's (OWEB) watershed assessment guidance manual could be amended with a component focusing on AIS. The kind of resources these different types of groups could use may be somewhat different; any associated training and materials developed would need to take these differences into consideration.

There were also similarities between the groups. The general desire for more information and training regarding AIS, although not universal, seems to cut across West Coast boundaries. AIS identification needs was a key common response. Interest in riparian plants was widespread. Most watershed groups tended to focus on the freshwater portion of their watershed with little mention about the estuarine portion of the watershed. Watershed groups in all states lacked AIS focus with regard to monitoring, prevention and control. Funding constraints was a shared primary reason behind that limited focus. The prevalence of funding constraints requires a realistic approach toward efforts to increase watershed group involvement in AIS activities. The relatively high watershed group personnel turnover rate experienced by some indicates the need for ongoing training, as well as a solid, well written set of guidelines with regard to AIS monitoring, prevention, and control/eradication. Overall, the responding groups reflected a genuine interest and desire to assist in the care and restoration of their watershed.

Due to the large difference in member composition between the watershed groups surveyed, and the broad range of focuses these groups have, as well as the extensive geographical area this survey covered and the consistency of many responses, this project's results might be extrapolated to reflect AIS trends that could be found in other geographical areas of the country. It also could be applied to differently structured groups (e.g., coral reef management programs, ocean based protection groups, or other types of environmental groups), and possibly internationally, to Canada and Mexico. Watershed group structures may be extensive across the United States in differing degrees of activity levels. Due to the limited number of responses received, it would be only prudent to extend the assessment to other areas, and other types of programs to see if the trends hold across other boundaries, and into other regions.

This project was an effective first step. However, given its limited scope, conclusions need to be qualified regarding the following issues. First, difficulties encountered in gaining access to watershed group guidance documents and associated watershed reports did not allow a complete evaluation of West Coast materials. Although the potential exists that some undetected documents do cover AIS in depth, this seems unlikely given the otherwise minimal coverage revealed by this project. Similarly, the watershed coordinator survey may have been more effective if a higher response rate could have been achieved. The lack of a comprehensive list of the watershed groups themselves, as well as their focus, geographic location, etc. made administration of the survey difficult. A higher response rate may have been obtained, if the original list of watershed groups

had been contacted prior to the survey mailing to verify that the group was in existence, that they indeed addressed a coastal watershed, and that they were interested in completing the survey. More time for multiple follow-up contacts may have elicited higher response rates.

Recommendations

This evaluation confirms significant opportunities, and associated benefits, to increasing the capacity of West Coast watershed groups regarding AIS management. Watershed groups can provide a potentially low cost approach to improve AIS detection, prevention, monitoring, and control/eradication at the local level. With an initial investment of guidance materials, training, and other tools, watershed groups can provide volunteer and staff effort at a scale beyond the capabilities of state, tribal, and federal resources. Prevention practices and information disseminated by local members of the community could be targeted in a way that fits within the norms of the community and may elicit a better response from watershed residents than information provided from external sources. Quick detection of new introductions would be more likely to occur utilizing local citizens who have a vested interest in the watershed. These groups could undertake control/eradication efforts as well with assistance from state and federal agencies. Adding the capacity to monitor for AIS to the existing monitoring role emphasized by most watershed groups is more cost-effective than creating entirely new programs. Ideally in the future, watershed groups will have accurate and complete data on AIS present in their waterways, actively strive to detect and prevent potential high-risk invaders, develop rapid response plans and funding sources to facilitate rapid eradication of new invasions, and have effective networking and cooperation to share information and reduce individual costs.

The following recommendations can help set an action plan for further engaging West Coast watershed groups in AIS issues:

1. Incorporate information into guidance documents in a way that helps watershed groups include AIS assessment, prevention, control, eradication, and monitoring in their watershed planning and management efforts.

This project indicates a clear causal link between the content of guidance documents and associated reports generated by watershed groups. Not only will inclusion of AIS information help spur coverage of this issue by watershed groups, but it will provide the information and tools necessary to ensure that coverage is consistent, comprehensive, and scientifically valid.

2. Provide more standardization of watershed group protocols/procedures.

Associated with the first recommendation, promoting consistency in how watershed groups assess, monitor, and manage AIS will allow for improved regional coordination and sharing of data/resources. Although no two watersheds are the same and this diversity is reflected in West Coast watershed groups (and is in some ways their strength), these groups differ widely in methods that limit cross-watershed cooperation. In some cases, the existing infrastructure for non-AIS watershed group activities complicates subsequent efforts to reduce inconsistency (e.g., varied

approaches among states in how macroinvertebrate community health is measured). However, because AIS is generally a new realm for these groups, the opportunity exists from the start to provide resources that will promote consistency. For example, relatively simple monitoring tools like Portland State University's zebra mussel sampling substrate program offer watershed groups a standardized approach that fits within the financial, technical, and human resource limitations of most watershed groups. AIS protocols should flexible enough to use in many different areas, but also have a standard format that would be easily upgraded to address newly emerging issues.

3. Provide additional training for watershed groups.

Training and other educational resources will be needed to reinforce and publicize guidance materials developed for watershed groups. This study confirmed that these groups desire more information and assistance with identification, eradication, long-term control and prevention of AIS. In particular, AIS identification was the most requested component of training. Other priority training items included how to address AIS impacts to restoration projects, ESA issues as they pertain to AIS, and funding sources. Training programs should reflect travel and schedule constraints noted by watershed groups in the surveys, and technology-based training aids (CDs, websites, etc.) should also be explored.

4. Increase AIS funding to watershed groups.

Even with additional knowledge and tools, watershed groups continue to make known that funding is a primary constraint in their ability to tackle new issues and projects. Although funding was not mentioned in the survey, several survey respondents identified funding as a need adequately address AIS in their watersheds. In some cases, watershed groups may decide to reprioritize use of their existing resources to focus on AIS – particularly in cases where there is recognition that if left unchecked, this threat could negate the investment of resources into other projects like fish habitat restoration. However, to truly develop comprehensive AIS programs by all watershed groups, additional funds will be necessary. Given that there are a number of watershed group funding programs – particularly at the state level – one initial step is to ensure that those programs accommodate or ideally emphasize AIS detection, monitoring, prevention, and control. Because these programs often prioritize "on-the-ground" projects that result in physical (and visible) improvements, prevention and detection projects may receive less support than control. Ironically, control of established AIS is much less cost-effective than projects that attempt to reduce potential invasion impacts.

By educating other stakeholders in the watershed, local partnerships might also provide funding and resources for watershed groups to address AIS. If the general public, as well as businesses and industry understand the economic costs that existing and potential AIS may pose to both the watershed and their livelihoods, more political and public willpower may be generated for both public and private funding options. The concept of "pay now or pay later" should be used to emphasize the benefits of investing in AIS before the problem mushrooms. .

Finally, beyond expanding direct resources for AIS management, organizations that fund watershed councils also need to ensure that funding proposals for non-AIS projects (e.g.,

development of fish rearing habitat) effectively address AIS risks that may compromise the project success. This approach not only protects investment in the desired project outcomes, but indirectly will support additional resources and effort placed on AIS management at the watershed level.

5. Create a closer link between watershed groups and the WRP.

Both the WRP and watershed groups would benefit from a closer working relationship. Ideally, this could be accomplished via a regional organization that represented and communicated with all Western watershed groups. Absent that opportunity, it would still be beneficial to provide for at least one watershed group position on the WRP to reflect the important perspective and capacity of these organizations.

6. Improve coordination among West Coast watershed groups

One important source of support to individual watershed groups is other groups dealing with similar issues. Facilitating increased interaction among watershed groups can promote the exchange of ideas, concerns, and techniques for addressing AIS. Given limited resources, working together with other watershed groups can help reduce training costs, avoid duplicative prevention programs, and pursue funding that may not be available to a single watershed group.

By nature of their local focus, it is often a challenge for watershed groups to interact across larger regional scales. At the beginning of this project, the nonprofit organization For the Sake of Salmon supported support this type of coordination effort between West Coast watershed groups. However, this organization's recent dissolution has left in gap in this coordination function. If an overall coordination mechanism among West Coast watershed groups can be established, AIS can be built into that mechanism. Otherwise, it would at least be prudent to develop specific AIS coordination mechanisms, including websites, listservs, and other technology-based strategies.

An immediate AIS coordination opportunity among watershed groups is establishment of an early warning system. If a new invasion is identified in a particular watershed, all potentially affected watersheds (based on potential natural or anthropogenic spread of the invader) should be alerted to be on the lookout for the AIS. Associated prevention and early response information should be disseminated and support given to those affected watershed groups.

Another model to consider is development within federal agencies of regional watershed group AIS coordinators, similar to a CALFED Bay-Delta coordinator position based within the U.S. Fish and Wildlife Service. Using this approach, similar positions could also be established along the West Coast. These coordinators could provide technical assistance to groups as well as facilitate information dissemination and cooperation between the groups.

7. Expand this needs assessment.

Although a good start, this needs assessment should be expanded to provide for additional document review and surveys in other regions. It should not only identify gaps in the current guidelines, but also identify any well-written documents that could be expanded or serve as

models. Another avenue of inquiry may be to perform a direct review of watershed group reports matched with the original references used to better document correlations between the two.

In terms of the watershed coordinators' survey, it would be beneficial to expand the survey both geographically and in scope in order to further probe knowledge of AIS, structural composition of the watershed groups (including funding agencies and levels of funding, size of staff, and technical help either on staff or available to them), and details about the associated watersheds themselves (e.g., the size of the watershed; major environmental stressors; the population of the surrounding area; historical and current encroachment upon the estuarine area; shipping and boat traffic volumes; presence of aquaculture facilities; industrial uses of the estuary, flow regimes and barriers; etc.). More direct survey methods (phone and in-person) would be valuable to allow for on-site surveys and appropriate follow-up questions, Ideally the survey and the training can be integrated to tailor the training and other resources to the needs of the individual watershed groups.

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